Agriculture Technical Work Group
Summary List of Recommended High Priority Mitigation Options

#	Mitigation Option Name	Straw Proposal Development Status
AW-1	Manure Digesters/Other Waste Energy Utilization (originally 1.4)	Reviewed and affirmed by CAT during Aug 7 meeting
AW-2	**In-State Production of Biofuels and Biofuels feedstocks (originally 1.2 and 1.3)**	**Ready for CAT Review**
AW-3	Significantly Expand Source Reduction, Reuse, Recycling and Composting (originally 6.1, including 6.4 and 6.5)	Reviewed and affirmed by CAT during Aug 7 meeting
AW-4	Agricultural Carbon Management (combines original options 2.3, 3.1, 3.3, 3.4, 4.1, 5.2)	Reviewed and affirmed by CAT during Aug 7 meeting
AW-5	**Agricultural Nutrient Management (combines original 3.2, 3.3, and 5.2)**	**Ready for CAT Review**
AW-6	**Reductions In On-Farm Energy Use and Improvements in Energy Efficiency (originally 5.1)**	**Ready for CAT Review**
AW-7	**Preserve Open Space/Agricultural Land (originally 4.2)**	**Ready for CAT Review**
AW-8	**Support for an Integrated Regional Food System (originally 5.3)**	**Ready for CAT Review**

Options previously reviewed and affirmed by the CAT are available on the CAT website under the most recent meeting of the Agriculture TWG.
http://www.ecy.wa.gov/climatechange/cat_twg_agr.htm

The following options received significant interest from the TWG but were not considered high priority.

Catalog #	Mitigation Option Name	Comments
1.1	Expanded Use of Woody Biomass Feedstocks for Electricity, Heat and Steam Production	Keep at moderate priority

AW-1. Manure Digesters/Other Waste Energy Utilization

Straw Proposal Development Status: Reviewed and affirmed by CAT during Aug 7 meeting

AW-2. In-State Production of Biofuels and Biofuels feedstocks

Straw Proposal Development Status: Ready for CAT Review

Based on AW Catalog Options 1.2 and 1.3

Mitigation Option Description

Washington state is distinctly different as an agricultural production region than the US Midwest – where corn and soybean-based biofuel production has dominated the landscape. Corn production in Washington is biophysically and economically limited to irrigated production as a rotational crop. Biophysical and economic limitations are even more constraining on current oilseed production in the state. Efforts are underway in both the public and private sector to increase the opportunity for Washington farmers to participate in the "traditional" biofuel markets of ethanol and biodiesel. Due to different potential feedstock crop choices and production practices for these fuels, it is likely that the GHG mitigation benefit of Washington ethanol, biodiesel, or other liquid biofuel feedstocks and production methods will be different than those based on Midwest production.

While Washington may not yet be competitive in traditional biofuel crops, we have a significant competitive advantage over other regions with non-traditional biofuel feedstocks and new crops – which ultimately will likely have more significant GHG mitigation benefit. Current research has identified the largest potential for current in-state biofuel feedstocks from: underutilized forest biomass; carbon-based municipal waste; and agricultural processing, field, and animal wastes. Furthermore, research has demonstrated that potential perennial biofuel crops, such as switchgrass, hybrid poplars, and other crops may be far more productive in our region than in other areas of the country.

Finally, any biofuels consideration should consider potential implementation trade-offs. For instance, removal of crop residues for biofuel generation will negatively affect soil carbon sequestration efforts. Biofuel promotion policies need to give consideration to environmental and economic trade-offs. Priority should be given to biofuels and feedstocks that maximize GHG mitigation benefits and minimize impacts on natural ecosystems. In particular, a Low Carbon Fuel Standard (LCFS) sets goals for reducing the carbon intensity of transportation fuels and creates a framework for promoting better performing liquid fuels. A Low Carbon Fuel Standard takes into account full lifecycle emissions and therefore provides new incentives and market value for feedstocks produced with lower emissions and better overall sustainability. We recognize that the CAT is considering a LCFS through Option T-11 in the Transportation TWG. The recommendations included in this Low-Carbon Biofuels option (AW-2) are integrally linked to implementation of the LCFS option (T–11). A LCFS would establish a demand for lower carbon fuels. This option addresses potential in-state feedstock supplies and research & development that are needed to meet the LCFS goal.

Mitigation Option Design

- **Goals:**

*The TWG decided to divide the goals for this proposal between quantifiable GHG reductions and other non-quantifiable goals for the development of a sustainable biofuel industry in the state. The intention of these goals is to push the state's biofuel industry beyond the existing biofuel / crop feedstock options and to give priority consideration to liquid fuels and feedstock crops that have greater relative GHG emission mitigation potential.

Quantifiable GHG mitigation goals:

- Increase utilization of waste biomass for biofuels by 3 million dry tons per year by 2020.
- Increase use of high biomass producing perennial bioenergy-feedstock crops to 80,000 acres by 2020.
- Promote *sustainable* production practices for the estimated 200,000 acres of likely feedstock production for ethanol and biodiesel feedstock crops.

Other Biofuel feedstock crop development goals:

- Give priority consideration for "low-carbon" liquid fuel feedstocks adapted to Washington's unique biophysical and economic conditions.
- Evaluate the opportunity "next generation" biofuels such as compressed biomethane and biobutanol present for Washington-based feedstocks. Invest in research, development and commercialization of next generation biofuel conversion technologies suited to Washington's unique feedstocks.
- Using a lifecycle analysis, assess the energy balance and GHG mitigation benefits of Washington-based biofuels.

- **Timing:**
  - Increase utilization of waste biomass for biofuels by 3 million dry tons per year by 2020. Initiation of this practice depends on further development of technologically viable biomass energy conversion technologies (anaerobic digestion of "wet" biomass is ready and improving, thermochemical cellulosic technologies are ready, "biological" cellulosic technologies are estimated to be ready by 2015).
  - Increase use of high-biomass perennial crops (hybrid poplar, switchgrass, etc.) to a total of 80,000 acres by 2020. Initiation of this practice depends on further development of technologically viable biomass energy conversion technologies (thermochemical cellulosic technologies are ready but economically marginal, "biological" cellulosic technologies are estimated to be ready by 2015).
  - Promote *sustainable* production practices on the approximately 200,000 acres in the state now in annual rotation, which are likely to produce corn or oilseeds for the existing commercial biofuels: starch-based ethanol and biodiesel.
- **Coverage of parties:** WSDA, WSU, UW, CTED, Ecology, Conservation Districts, Private Sector
- **Other:** Washington State realizes that we cannot displace all petroleum based fuels with

biofuels. We also realize that we have a solid opportunity to reduce a percentage of fuel imports with a regional biofuels production strategy by working with the Western States Climate Action Initiative states/provinces to develop integrated solutions.

Implementation Mechanisms

[TWG has begun to provide input; to be discussed at next CAT meeting]

Related Policies/Programs in Place

Types(s) of GHG Reductions

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

[TWG has begun to provide input; to be discussed at next CAT meeting]

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-3. Significantly Expand Source Reduction, Reuse, Recycling and Composting

Straw Proposal Development Status: Reviewed and affirmed by CAT during Aug 7 meeting.

AW-4. Agricultural Carbon Management

Straw Proposal Development Status: Reviewed and affirmed by CAT during Aug 7 meeting.

Based on AW Catalog Options 2.3, 3.1, 3.3, 3.4, 4.1, and 5.2

AW-5. Agricultural Nutrient Management

Straw Proposal Development Status: Ready for CAT Review

Based on AW Catalog Options 3.2, 3.3, and 5.2

Mitigation Option Description

Agricultural nutrients are critical to the sustainable production of food, fiber and energy – and in many cases a primary cost of agricultural production. Nutrients are derived from many sources including fossil fuels, mined materials and biological materials / fixation. Poor nutrient use efficiencies in agricultural systems, the consequence of biological, technological and management factors, lead to considerable losses of nutrients (especially nitrogen) to the environment. Agriculture is the primary source of nitrous oxide (N_2O) emissions in the US, a greenhouse gas > 300 times as potent as CO_2. In addition to N_2O emissions, reactive forms of nitrogen are lost to the environment as nitrates and ammonia. While these losses have negative environmental ramifications, they also represent significant financial consequences for farmers. Improving on-farm nutrient use efficiencies; alternative, biological sources of nutrients, and enhanced recovery / relocation of nutrients will substantially reduce ag-related greenhouse gas emissions, improved economic returns for farmers, and reduced fossil energy use.

This option seeks to reduce GHG emissions from nutrient use by implementing improved management on farms, which will lead to more efficient use of fertilizers. This more efficient use could lower N_2O emissions from crop soils and leaching, as well as emissions associated with the production, transport, and application of commercial fertilizers. *[Note the linkage to one of the goals under AW-1, where the products from anaerobic digester projects are to be targeted for use to offset commercial fertilizer use]*

Mitigation Option Design

- **Goals:**
  - Reduce CO_2 emissions associated with excess applications of natural gas derived nitrogen and mined phosphorous through implementation of farm nutrient management plans and soil testing by 10% statewide.
  - Reduce N_2O emissions and use of natural gas derived nitrogen by an average of 10% per acre in the dryland production regions through application of *precision agriculture* technologies which reduce both total N applied as well as reduced N_2O evolution from soils.
  - Reduce N_2O emissions and use of natural gas derived nitrogen and mined phosphorous through recovery of 50% of the nitrogen and phosphorous from 25% of existing sources of nutrient concentrated biomass, such as manure, by 2020.
  - Reduce CO_2 emissions associated with the use of natural gas derived nitrogen and mined phosphorous by redirecting 25% of Washington inventoried biomass-based nutrients to farms by 2020.

  - Reduce CO_2 emissions by 20% through displacement of natural gas derived nitrogen with the use of biologically fixed nitrogen practices on 250,000 acres by 2020.

- **Timing:**
  - Implement farm nutrient management planning and soil testing state-wide by 2012, reduce excess nutrient applications by 10% of total nitrogen applied by 2020.
  - Increase the number of acres using *precision nitrogen management* technologies by 250,000 acres per year until 2020
  - Redirect an additional 2.5% per year of biomass-derived nutrients to farms until 2020.
- **Coverage of parties:** WSU, WSDA, Ecology, Conservation Districts, EPA, Private Sector
- **Other:**

Implementation Mechanisms

[TWG has begun to provide input; to be discussed at next CAT meeting]

Related Policies/Programs in Place

TBD

Types(s) of GHG Reductions

TBD

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-6. Reductions In On-Farm Energy Use and Improvements in Energy Efficiency

Straw Proposal Development Status: Ready for CAT Review

Based on AW Catalog Options 5.1

Mitigation Option Description

It has been estimated that the US food system as a whole (i.e. seed to dinner table) consumes as much as 1/5th of the US energy supply. Furthermore, the food system is one of the few sectors that uses every type of energy product, from electricity and thermal energy to liquid fuel to refined fertilizer, chemical, and material products derived from fossil fuels. A large fraction of this energy consumption occurs on-farm through the material and fuel consumption needed to produce crops and livestock.

The policy aims to reduce on-farm energy use and associated GHG emissions through the application of energy efficiency measures or on-farm energy projects.

Mitigation Option Design

- **Goals:**
  - Reduce liquid fuel consumption by an average of 25% per acre through adoption of equipment, technologies and cropping system practices that reduce the number of "tractor trips" across a field.
  - Improve electrical and thermal energy use efficiencies in agricultural facilities by 10%.
  - Reduce use of irrigation-related energy use through adoption of water use efficiency technologies *and* improved cropping system practices by 10%.
  - Substitute "on-farm" renewable energy technologies (solar, wind, geothermal) for fossil-fuel derived electricity and thermal energy products by an estimated 10MW capacity by 2020.
- **Timing:**
  - Reduce liquid fuel consumption: increase use of no-till / direct-seed farming practices in the dryland (high and intermediate rainfall zones) region of the state by an average of 100,000 acres / year between 2010 and 2020 for a total of at least 1 million acres (total no-till acres will be ~ 25% of dryland acres).\
  - Reduce liquid fuel consumption *and* irrigation-related energy use: increase use of high-residue farming (i.e. cover crops, no-till, etc.) practices in the irrigated region of the state by 30,000 acres / year between 2010 and 2020 for a total of at least 300,000 acres (25% of irrigated acres).
- **Coverage of parties:** WSDA, WSU College of Agriculture, Human and Natural Resources Sciences, WSU Extension Energy Program, Conservation Districts, Private Sector

- **Other:** *There is a significant amount of overlap between energy efficiency goals and goals in the ag carbon and ag nutrient management straw proposals. The same practices that can be employed for improving soil carbon sequestration or reducing nutrient use can be used to reduce ag energy use.

Implementation Mechanisms

[TWG has begun to provide input; to be discussed at next CAT meeting]

Related Policies/Programs in Place

Types(s) of GHG Reductions

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-7. Preserve Open Space/Agricultural Land

Straw Proposal Development Status: Ready for CAT Review

Based on AW Catalog Options 4.2

Mitigation Option Description

The Agriculture & Waste TWG recommends that Washington vigorously implement programs to reduce the rate at which agricultural lands are converted to developed uses, while protecting property rights and responsibilities. By protecting agricultural areas from development, the carbon in above-ground biomass and below-ground soil organic carbon can be maintained and additional emissions of CO2e to the atmosphere can be avoided. It is estimated that approximately 23,000 acres of Washington farmland are converted out of agriculture every year (USDA, 1997 Natural Resource Inventory), contributing significant CO2e emissions through the loss of stored carbon in biomass. Conservation of the agricultural land base can occur through a variety of planning, regulatory, market development, and incentive-based strategies. Conservation of the agricultural *land base* complements and supports the carbon management *farming practices* addressed in AW – 4. This option also supports the smart growth policies under options RCI-13 and T-4.

Mitigation Option Design

- **Goals:** The rate at which existing crop and rangelands are converted to developed uses should be reduced. By 2010, agricultural land conversion should be reduced by 30%. By 2020, the rate at which agricultural land is converted should be reduced by 50%.
- **Timing:** By 2010, agricultural land conversion should be reduced by 30%. By 2020, the rate at which agricultural land is converted should be reduced by 50%.
- **Coverage of parties:** Landowners, local governments, relevant state agencies, and non-governmental organizations, Western Climate Initiative.
- **Other:** WA farmland urbanization rate based on NRI = 23,000 acres/yr 1992-1997.
    - By 2020, achieving these goals would save **** acres of land per year from being converted to developed uses. This would retain the above- and below-ground carbon on these lands, as well as the carbon sequestration potential of these lands. Achieving these goals in conjunction with smart growth policies (Options RCI-13 and T-4) may also contribute toward a reduction in transportation emissions through more efficient development and lower vehicle use.

Implementation Mechanisms

[TWG has begun to provide input; to be discussed at next CAT meeting]

Related Policies/Programs in Place

[TWG has begun to provide input; to be discussed at next CAT meeting]

Related Policies/Programs in Place

Types(s) of GHG Reductions

TBD

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

[Insert text here]

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD

AW-8: Support for an Integrated Regional Food System

Some TWG members have expressed reservations about the inclusion of this policy option.

Straw Proposal Development Status: Ready for CAT Review

Based on AW Catalog Options 5.3

Mitigation Option Description

NOTE: Italicized words are comments, rough spots, articles for more work, etc.

A regional food system that integrates the whole supply chain (production, processing, packaging, distribution, purchase, preparation, and waste management) holds significant potential for reducing greenhouse gas emissions. Life cycle assessment research that includes traditionally externalized factor inputs - such as food production practices, transportation method (boat, truck, plane), type of vehicle fuel used in transportation - and addresses more than just food mile measurements, is the first goal and will help determine the actual size of GHG reduction.

A successful regional food system will also provide new markets for regional farms of varying sizes, create new jobs and markets for food and energy companies in state, reduce petroleum use, and strengthen rural communities through the retention and circulation of profits within the regional economy. Ultimately agricultural lands can be preserved since there are now more robust economic options for farmers, which can reduce the risk of farming as a source of financial debt concern.

Low carbon footprint food products improve air, soil and water quality, particularly when integrated with carbon, nutrient, and water management strategies as proposed in other AW TWG strategies. By supporting low carbon food products we support the production of low carbon farming practices, like the use of on-farm renewable energy systems; organic carbon sequestration method including low-till/no-till methods; and agricultural carbon, nutrient, and water management strategies.

(*Needs more work)* A regionally vibrant food system should not penalize current import/export successes, especially those that are working to implement carbon reduction strategies. This policy provides incentives to import/export supply chains that meet our GHG emission goals by rewarding carbon reduction in their existing supply chains for any product that passes through Washington ports and has met stated GHG emission goals.

This option has cross benefits that complement some Transportation, Energy, and the Residential, Commercial, and Industrial TWG mitigation strategies, with potentially larger savings by utilizing low carbon fuel standard fuels, in-state biofuels, and/or for the co-location of renewable energy systems with regional food infrastructure requirements.

This option is focused on impacts and issues after farm production and complements AW TWG options that address farm production, solid waste, and open space and farmland preservation.

Overall, this policy is focused on looking across traditional issues and approaching the issues of GHG emission reduction, increasing clean energy jobs, and reducing fuel imports by integrating various issues, and whole supply chains, in to one cohesive strategy. We need to connect our policies horizontally, across the different sectors of society, in order to reach the levels of reduction and change we desire.

Mitigation Option Design

- **Goals:**
  - Quantify potential gains through life cycle assessments of current and relevant potential food products by Nov. 1, 2011.
    - *Huge task but needed*
    - *designed around agricultural products optimized for our diverse growing regions.*
  - Reduce GHG emissions related to food processing, distribution, packaging, and storage by 0.5 MMtCO2e per year by 2020, 1 MMtCO2e per year by 2030, and 1.5 MMtCO2e per year by 2050. *(aggregate relevant targets from other TWGs; subtract duplicate quantities).*
    - Target reduction goals to be revisited once initial research goal has been satisfied.
    -
  - Integrate mitigation with cross-sector strategies emerging from transportation, energy, and residential/commercial/industrial technical working groups by December 2007.
  - Increase in-state production, processing, packaging, distribution, and availability of regional food for regional markets by 2015. Utilize Idaho, Oregon*, (and British Columbia?And AK?Northern CA?)* food products when feasible.
  - Reduce by 20% by 2020 the transportation distance that individuals, particularly those with limited food choices, have to travel to purchase recommended food such as those included in federal dietary recommendations, partly by encouraging delivery services that minimize physical store trips (*Quantify job shift/loss if this means loss of physical jobs with some offsetting gains in delivery services)*.
- **Timing:**
  - Quantifying research of true potential by Nov. 1, 2011.
  - GHG reductions of 0.5 MMtCO2e per year by 2020, 1 MMtCO2e per year by 2030, and 1.5 MMtCO2e per year by 2050.
  - State and local public institutions, including public schools, will lead by example by sourcing local food system products:
    - Voluntary 15% sourcing by 2010.
    - 15% requirement by 2015.
    - 20% requirement by 2020.

- **Coverage of parties:** State Department of Ecology, State Department of Community, Trade and Economic Development, State Department of Agriculture, Office of Superintendent of Public Instruction.
- **Other:**
    - Clean energy jobs, if (at least) defined to include any job in a company that utilizes renewable energy in its processes, will increase related to food processing, transportation, and waste disposal/composting. Some job shifting is expected to occur across the transportation, shipping, and retail sectors.
    - Reduction in fuel imports will occur from incentivizing biofuel that is feasibly grown and processed in-state, in conjunction with the Low Carbon Fuel Standard. And as through meeting the low carbon fuel standard, production of biofuel feedstocks in-state will lead to more GHG reductions and sequestration within the agricultural sector.
    - Tax revenue and community wealth will increase due to the retention/capturing of economic activity dollars in regional communities. New research on the economic benefits of locally directed spending shows that for every consumer dollar spent at community-based restaurants and groceries, more than 45 cents of additional economic activity is generated as the spending circulates through the state economy[1]. Regionally-directed activity creates tax revenue that can be used to fund GHG reduction incentives.
    - A carbon market mechanism that includes an economically attractive option for small and mid-size producers will generate an increase in economic activity, allowing public and private budgets to utilize precious resources for other items and needs. Money saved from this and other carbon-market related activity can be used to fund incentive packages that support the growth of this and other GHG reduction strategies.
    - Food production waste that is sourced from organic and/or biostocks, including livestock manure, dairy waste, and organic municipal solid waste, may be a source of renewable energy for food processing facilities, or at least a viable feedstock for any biofuel or bioenergy processing facilities.
    - Larger gains can be realized by co-locating biofuel and renewable energy facilities with food processing centers, and also through incentives to use biofuels for transportation of food ingredients and finished goods.
    - Creation of in-state construction-related jobs.

Implementation Mechanisms

[TWG has begun to provide input; to be discussed at next CAT meeting]

Related Policies/Programs in Place

TBD

[1] Based on the Sustainable Seattle report "Why Local Linkages Matter: Findings from the Local Food Economy Study", forthcoming October 2007

Types(s) of GHG Reductions

TBD

Estimated GHG Savings (in 2020) and Costs per $MtCO_2e$

- **Data Sources:**
- **Quantification Methods:**
- **Key Assumptions:**

Contribution to Other Goals

- **Contribution to Long-term GHG Emission Goals (2035/2050):**
- **Job Creation:**
- **Reduced Fuel Import Expenditures:**

Key Uncertainties

TBD

Additional Benefits and Costs

TBD

Feasibility Issues

TBD

Status of Group Approval

TBD

Level of Group Support

TBD

Barriers to Consensus

TBD